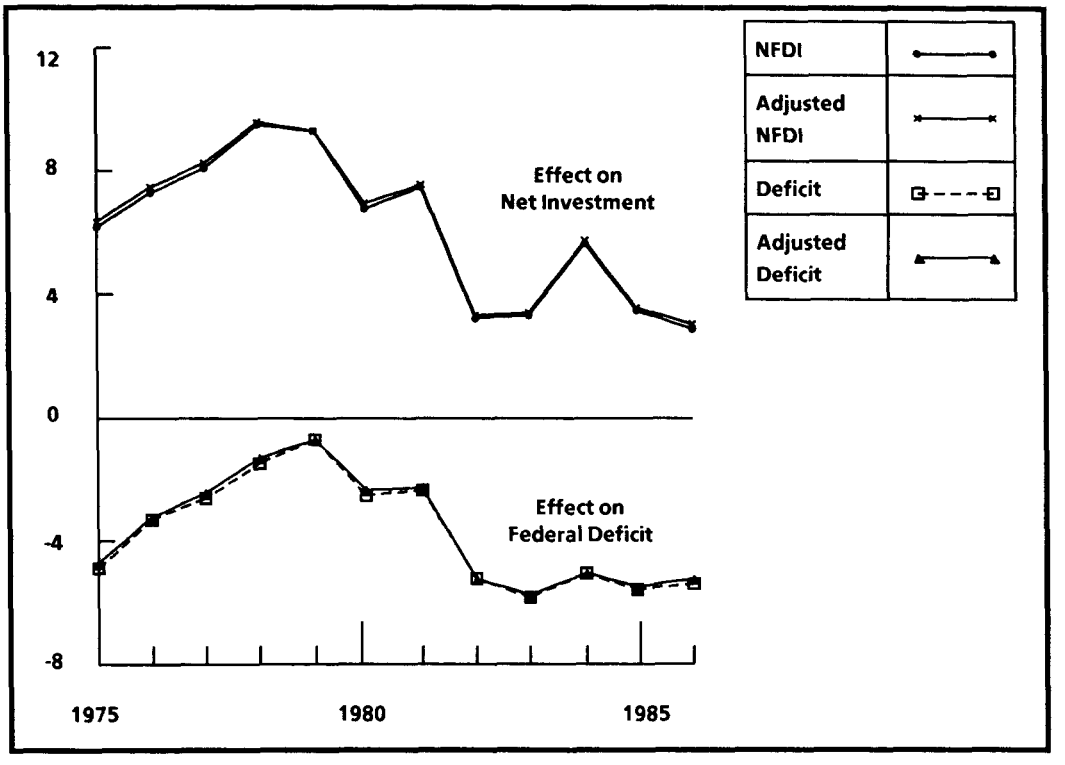
FIGURE 4. EFFECTS OF FEDERAL INVESTMENT ON NATIONAL SAVING AND INVESTMENT RATES (As a percent of NNP)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis.

NOTES: Adjustments for federal net physical investment are based on deducting withdrawals from capital stocks from gross investment. NFDI = Net fixed domestically owned investment.

values.2/ Thus, public investment would be reflected in private totals by its effect in raising the value of private investment purchases. On the other hand, improvements on public capital raise values for all existing as well as new private property, so that the private investment totals would tend to undercount the value of public investment in all except rapidly growing communities. National accounting does not now adjust for capital gains and losses, but adding public investment to national totals would recognize that a part of national changes in wealth (whether captured in private values or not) is attributable to expansions of public fixed facilities.

2. Charles R. Hulten and Robert M. Schwab, *Income Originating in the State and Local Sector* (New York: National Bureau of Economic Research Working Paper No. 2314, July 1987).

CHAPTER V

EXTENDING CAPITAL CONCEPTS

Under the strict interpretation adopted in Chapter IV (following NIPA principles for business and household investment), federal investment activity would add $4 billion or less to national (net) investment totals (at 1982 prices) over each of the past 10 or so years. But using the broadest interpretations, federal investmentlike activity would have added up to $60 billion to net investment in 1986. Of that amount, net investment in defense assets would have added $17 billion a year (in 1982 prices), up from negligible levels before 1978. Federal research and development programs that are designed to promote commercial innovation would have added an estimated $10 billion to $20 billion a year in net national scientific or intellectual capital; and subsidies for physical capital investment would have added a net $11 billion to $22 billion to state and local assets. Federal education and training assistance, if included, would add an additional $20 billion a year to national investment totals, unadjusted for depreciation.

The picture is somewhat different for the period 1980-1986. Overall, investment under the broadest interpretation has increased since 1980, but this increase derives from the large rise in net investment in defense assets and in spending on military research and development. Other categories have shown stable or declining activity. Neither individually nor together would the expanded investment categories be sufficient to reverse or even offset the falloff in domestic saving and investment recorded in official data.

Not all of these investments would raise saving attributed to the federal government. Because some of them are financed from federal subsidies, the saving and investment activity would logically be accounted in the sector that receives the subsidy, makes the investment, and operates, maintains, or uses the assets created. Thus federal capital grants for infrastructure would increase national investment by

raising state and local government saving and investment, and federal support for education and training would increase national human capital by raising saving and investment in households. Of the overall 2.5 percent of net national product invested in public capital under the extended concepts, only about half would be accounted as federal investment.

INVESTMENT IN DEFENSE ASSETS

Defense assets--weapons, and the ships, aircraft, and structures needed to transport, deploy, and launch them--can be considered an extension of national capital since they provide defense services over a number of years. If national defense were provided under contract with private armies, this long-lived property would be considered capital. Government defense forces might thus be viewed as alternatives to such private armies, and the weapons and associated facilities they use would form part of the capital stock.

On the other hand, even under this formulation, weapons systems could be considered inventories or stockpiles for future use, somewhat like a firm's supply of raw materials. Their claim as fixed assets rests on the deterrence they provide without actually being put to use. In time of war, counting these assets as fixed capital would imply that the nation was poorer to the extent that they were used up. Counting defense assets as inventory, however, would require their periodic revaluation--much as producers' stocks are revalued to reflect changes in their potential contribution to profits.

Thus, to the uncertainties already seen in estimating depreciation on public assets must be added the difficulty that, in the case of defense assets, the amount and value of the services the assets produce (and the public consumes) are unknown. Capital consumption for defense cannot be related to the contribution of assets to output but only to characteristics of the assets themselves. If regarded as inventories, defense assets would be added to stocks when purchased and would enter annual federal spending accounts only when withdrawn or used. Capital consumption would then be measured in terms much like the second measure used for federal assets in Chapter IV. In that case, defense procurement of weapons systems would not, in ordinary

years, add to measures of federal spending or deficits. But weapons systems are subject to technical obsolescence and, after a few years, may not offer the same level of service as when new. To the extent that new purchases restore a diminished technical edge, or respond to hostile actions, they may merely replace value lost to the inventory. Moreover, many of the facilities--ships and aircraft, for example--undergo physical wear and tear while in service, which argues for estimating regular annual allowances for capital services.

Net Spending on Defense Assets

Between the end of the Korean war and 1978, net investment in defense assets was negligible. This measure treats defense assets, like business capital, as subject to physical wear and tear, and depreciates them uniformly over the service lives shown in Appendix A. During the major military buildup of the 1950s and early 1960s, net defense investment maintained a rate of around $5 billion a year (in 1982 prices) for only three years. In many other years during the period, net investment was negative. Table 6 shows net investment based on deducting straight-line depreciation; Appendix Table B-2 shows gross investment in defense assets.

In the late 1970s, however, net investment began to rise, going from about $7 billion in 1978 to $21 billion in 1982. Net investment in subsequent years has been lower, but the total during 1982-1986 exceeded that of the earlier largest peacetime defense buildup from 1960 through 1966 by a factor of four.

Implications for National Saving and Investment Data

If purchases of defense assets were treated as investment in national income data, measures of federal saving--though remaining unchanged for much of the postwar period--would be increased from current levels by as much as 0.6 percent of net national product, and domestically owned fixed investment would rise from 2.9 percent of NNP to 3.5 percent. This adjustment, though it would reduce the federal deficit measure by around one-seventh, would not alter the general downward trend of national investment levels. Under the revised

definition, the falloff in national investment from its rates above 8 percent of NNP in the 1970s remains steep (see Figure 5).

INVESTMENT IN INTANGIBLE CAPITAL

Investment in intangible or intellectual capital--spending on research and development activity--can claim to be part of national investment because the resulting knowledge may alter products and production

TABLE 6. NET INVESTMENT IN DEFENSE ASSETS
(NIPA basis, in millions of dollars, at 1982 prices)

Calendar Year	Net Equipment Procurement	Net Silo Construction	Net Investment Defense Assets
1949	-41,779	43	-41,779
1959	-814	61	-685
1969	-1,338	-54	-1,357
1970	-1,491	31	-1,538
1971	-2,625	56	-2,679
1972	2,244	67	2,275
1973	-772	60	-716
1974	-2,157	52	-2,090
1975	2,155	2	2,215
1976	3,751	-81	3,803
1977	1,652	-89	1,654
1978	7,336	-89	7,255
1979	9,692	-88	9,603
1980	8,875	-88	8,786
1981	9,757	-88	9,669
1982	20,667	-87	20,579
1983	14,850	-87	14,762
1984	11,105	-87	11,018
1985	15,777	-87	15,690
1986	16,881	-85	16,796

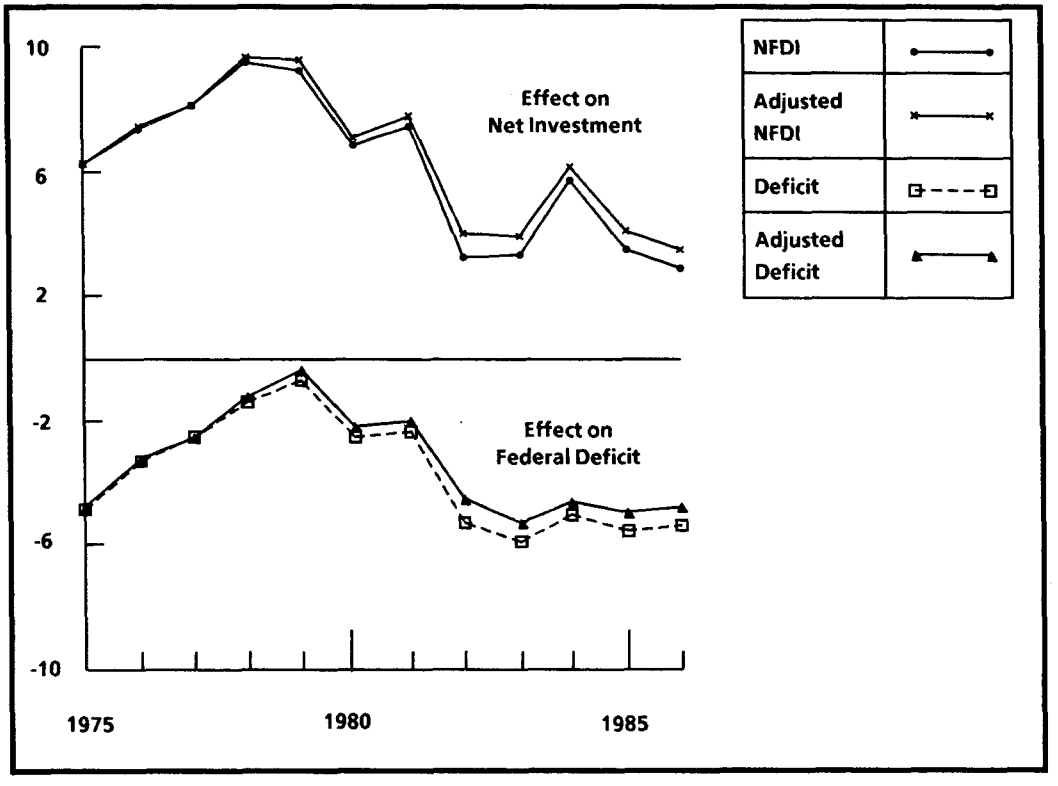
SOURCE: Congressional Budget Office based on budget data, and Bureau of Economic Analysis.

NOTE: Based on straight-line depreciation.

processes. Finding and spreading new knowledge and technologies may create new income over long periods.

Rigorous standards of what to include, however, are difficult to devise. Research and development expenditures are relatively loosely defined compared with the outlays on construction or fixed equipment that constitute physical investment. Classifying research and development as investment would transfer scientists' and other researchers' salaries and laboratory costs from operations to investment.

FIGURE 5. EFFECT OF INVESTMENT IN DEFENSE ASSETS ON NATIONAL SAVING AND INVESTMENT RATES
(As a percent of NNP)



SOURCE: Congressional Budget Office based on data from the Bureau of Economic Analysis.

NOTE: Adjustments are based on net investment after deducting equal annual amounts for depreciation.

NFDI = Net fixed domestically owned investment.

(Spending for laboratories themselves and for major equipment used in research and development would be classified as investment in physical capital.) Research and development inevitably include unsuccessful as well as successful projects; but it is not easy to establish the success and commercial usefulness of such activities until well after their completion.

Research and Development

The two measures of net investment through research and development that are proposed in Chapter III would, if included in national investment totals, show divergent trends. As Table 7 indicates, despite a rapid increase in resources for federal research and development programs in the last decade, resources for net federal investment in those areas of research with the greatest commercial or industrial potential have remained unchanged at about $10 billion a year--apart from a bulge in energy development spending during 1978-1981.1/ Measures of net investment through all federal research and development programs, on the other hand, show a rapid increase from negative levels 10 years ago to around $20 billion a year. These measures reflect write-offs of around $5 billion in 1986 in commercially oriented programs, and about $26 billion overall, for past development efforts that have become obsolete or have been fully embodied in production.

The difference between the two series in Table 7 reflects several influences. First, the switch in the space program from a developmental to an operational phase in the late 1960s and early 1970s led to a greatly reduced space research program over the past 20 years as compared with the intense development activity of the sixties. During this period the usefulness of the vast array of findings from the 1960s

1. Estimates of net R&D are based on National Science Foundation data for spending and on writeoffs for past development as set out in Chapter III. The "commercially oriented" category includes all federally funded research and development except development expenditures under military, space, health, and environment research programs. As discussed in the last chapter, these are the programs that analysts of technical change identify as most likely sources for commercial innovation spinoffs that could increase national income by reducing production costs. Gross spending data corresponding to the net investment series are shown in Appendix Tables B-3 and B-4.

in fostering new products or processes in space and nonspace areas has gradually dwindled. Space research in the last 10 years has not offset this decline; the space program and users of its research findings have been largely living off the 1960s effort. As measured here, net additions to the scientific or knowledge base for industrial innovation from the space program in the past 10 years have been negative. This would imply that federal efforts to find innovative production processes and products are less than sufficient to offset the decline in technologies that are becoming obsolete.

Some caveats should be entered here. First, federal and private research are more often complementary than competing, and federal programs are sometimes thought to be in the riskier fields. Thus, having demonstrated feasible space flight in the 1960s, space research may now be much more evenly spread between public and private activity. Moreover, federal spending on research and development cannot capture the vast additions to knowledge gained by astronauts in operational missions, so that the investment base in any particular program against which earlier development might be written off could well be greatly understated. Second, unlike physical or even human capital, the assets created in intangible investment are not owned by the investing sector but exist in the public domain. Thus it is somewhat artificial to estimate net investment series for research and development either in different economic sectors (federal or private) or in different programs (health, space, and so on). Moreover, whereas negative investment has observable results in other fields--say, deteriorating structures or declining skill levels--it is difficult to devise tests of the subtle changes in the national capacity to seek innovations and technical change that would follow from negative investment in intellectual capacity. Under the alternative net measure shown in Table 7, overall net scientific investment has not been negative at any time. Some analysts computing intellectual capital stocks do not write off development at all, so that their estimates of net and gross investment (gross investment is shown in Appendix Tables B-3 and B-4) are the same. There is no verifiable way to distinguish which of these three measures reflects current changes in national capacity for innovation.

A second difference in the two series in Table 7 is that the increase in net federal investment in overall scientific or intangible capital reflects largely an expansion of efforts to find applications from earlier

civilian and military research to national defense. Military R&D programs are now approximately 90 percent for development and 10 percent for basic or applied research. Most of the rapid rise in military research and development since the late 1970s has been in development programs that seek to apply known technology to military equipment and systems. Military programs seeking knowledge through basic and applied research have not seen the same increase; spending on these has remained around $3 billion a year (after correcting for price changes) since 1975. Defense programs, however, are by far the largest and fastest growing, increasing from 50 percent of federal research and development in the mid-1970s to 70 percent now.

TABLE 7. FEDERAL AND PRIVATE NET INVESTMENT IN INTELLECTUAL CAPITAL THROUGH RESEARCH AND DEVELOPMENT
(NIPA basis, in millions of dollars, at 1982 prices)

	Federal Science, Industry, and Commerce Applications						
	Federal R&D			Federal Research			
	Energy	General Science	Agriculture, Transport, and Other	Military	Space	Health	Environment and Natural Resources
1960	n.a.	n.a.	n.a.	4,374	1,222	1,354	344
1969	n.a.	n.a.	n.a.	4,597	2,275	2,769	642
1975	287	983	1,881	2,888	1,352	2,886	864
1976	1,051	1,045	1,417	2,722	1,783	3,025	807
1977	1,592	972	1,461	2,731	1,824	2,446	751
1978	2,107	969	1,573	2,808	1,744	3,486	819
1979	2,679	991	1,300	2,764	1,788	3,800	1,007
1980	2,431	957	1,181	2,988	2,386	3,958	964
1981	2,301	943	955	3,054	1,582	3,962	832
1982	1,436	960	646	2,923	935	3,992	777
1983	729	939	538	3,079	1,104	3,960	765
1984	771	1,016	681	2,973	1,296	4,021	733
1985	853	1,077	770	2,766	742	4,338	716
1986	-508	1,200	824	2,843	745	4,533	727

SOURCE: Congressional Budget Office, based on data from the National Science Foundation and the Office of Management and Budget.

But this expansion in military R&D has not been at the expense of federal support for industrially or commercially oriented research and development. Spending on basic and applied research in programs other than defense or space has been fairly stable at around $6 billion to $7 billion a year (in 1982 prices) since the late 1960s, about half of it for health and medicine. Virtually all of this represents net investment in scientific capital. The remainder of the $10 billion in net investment includes small amounts of military and space research, and net development under energy and other federal R&D programs.

TABLE 7. (Continued)

Federal Industrial/ Commercial R&D	Other Federal Development				All Net Federal R&D	Net Private R&D
	Military	Space	Health	Environment and Natural Resources		
n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	22,841
11,140	-7,355	-5,792	607	162	-1,238	15,642
11,850	-7,516	-6,652	454	121	-1,742	16,240
11,776	6,599	7,182	259	37	-1,708	16,718
13,506	-5,666	-7,437	342	55	799	18,009
14,330	-5,559	-6,881	278	1	2,169	19,302
14,864	-3,953	-6,377	113	-60	4,587	21,348
13,629	-2,631	-5,118	0	-104	5,776	22,912
11,668	-768	-5,298	-173	-182	5,248	24,214
11,116	1,443	-4,784	-256	-200	7,317	25,617
11,491	4,823	-3,673	-272	-201	12,168	28,454
11,261	9,005	-2,835	-244	-225	16,962	31,494
10,365	12,444	-2,055	-247	-215	20,293	33,939

NOTE: n.a. = not available.

These patterns imply that the national value of federal research and development programs (measured by the increasing business income following innovations) is lower now than 10 (or 20) years ago because of the increasing proportion of spending for noncommercial development. Although federal programs now provide half the funding for national research and development efforts, they contribute only one-quarter of net commercial scientific capital. (Net private investment in scientific capital is shown for comparison in Table 7.) This is just under half the share of 10 years ago, underlining the shift in federal support for R&D from a nearly equal partnership with industry in financing industrial innovation to a very subordinate role.

Implications for National Saving and Investment Data

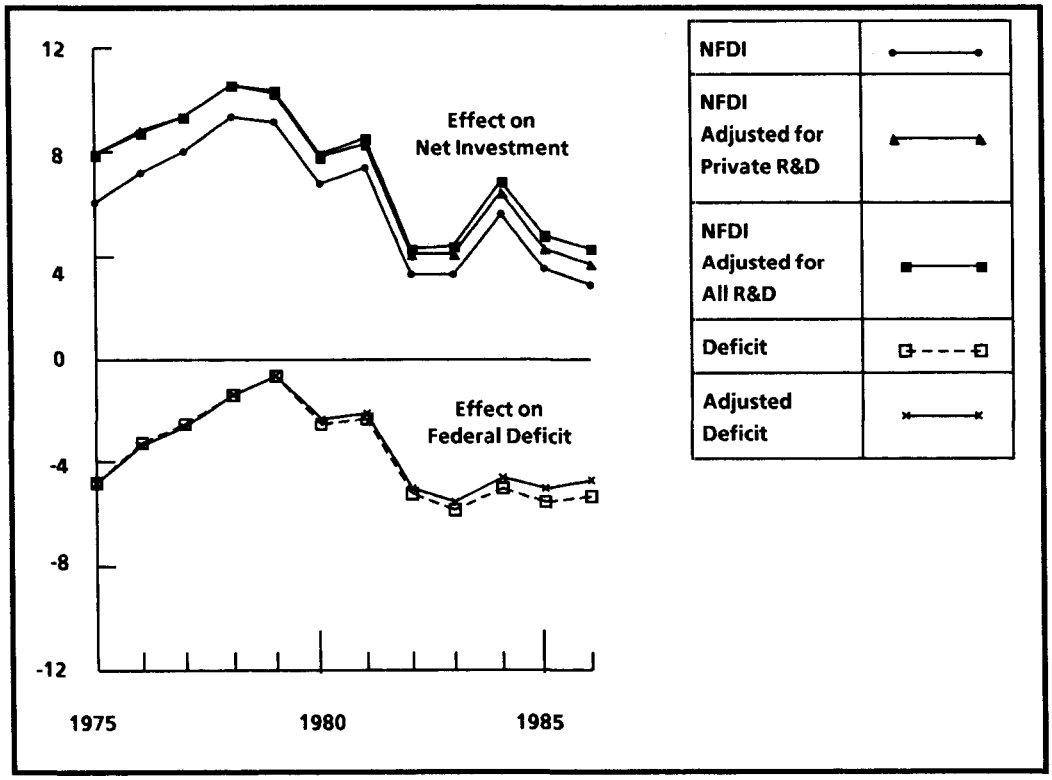
Extending the concept of capital to include scientific capital resulting from R&D would, if carried over to all sectors, increase the measure of national income. At present, business income is measured net of expenditures on R&D. Under expanded capital accounting, business R&D spending would be counted as purchases (from profits) of capital (research) services, and business income would reflect only a deduction for obsolescence of past development efforts. Business saving and income (and hence corresponding national measures) would thus be increased by net private R&D investment.

Adjusting income, saving, and investment data for net investment in R&D raises domestically owned investment rates by up to 0.6 percent of (revised) NNP for federal R&D programs and 1.4 percent overall, when firms' net investment is included. If only the most commercially oriented federal R&D programs are counted as investment, the adjustment is only about 0.3 percent of NNP. The overall adjustment, though larger in 1986 than at any other time in the 1980s, is lower than levels of the mid-1970s, indicating that recent fast growth has not restored research and development to its share of 10 years ago in national income (see Figure 6).

LOANS AND GRANTS TO OTHER SECTORS

A further extension of the definition of federal investment would include federal contributions to investment in other sectors that are, in both accounting and economic terms, income transfers. They occur through loans and grants to individuals and other governments. National income data reflect this: federal financial aid is recorded as federal intergovernmental grants and as corresponding income or revenue that is spent or saved by its recipients along with other income. Thus construction and other fixed purchases financed with this

FIGURE 6. EFFECT OF INVESTMENT IN RESEARCH AND DEVELOPMENT ON NATIONAL SAVING AND INVESTMENT RATES (As a percent of NNP)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis and the National Science Foundation.

NOTE: Adjustments are based on net investment in all R&D categories.

NFDI = Net fixed domestically owned investment.

aid are recorded in the sector that received the aid. Moreover, from an economic point of view, the grants and loans are not greatly different from revenue sharing (which also financed some investment) since, according to the weight of evidence, they do not induce additional investment by recipients but instead substitute for other sources of funds (see Chapter III). In other words, states, local agencies, and individuals receiving federal aid do not appear to invest more of their aid-enlarged income than they would have if the extra income had come from nonfederal or untied sources. Though it is often tied to certain capital programs, federal aid merely allows resources that would otherwise be devoted to those purposes to be diverted to other uses.

The role of federal financial aid in national infrastructure programs has nevertheless been--and remains--substantial. Federal grant programs now amount to nearly half of all physical investment by state and local governments, and nominally cover 80 percent, on average, of the cost of eligible investments. Federal credit subsidies have been important in shaping certain patterns of regional development--for example, through assistance for rural water, electricity, and housing development. This aid ultimately accrues to households through low rates for services. The following sections discuss patterns in federal investment financing for states and localities and households, through grants and credits subsidizing physical investment.

Subsidies for Physical Investment

The argument for counting federal capital grants and credit subsidies for physical investment as part of federal investment activities is that they nominally finance infrastructure and other types of investment that conform with the standard criteria for capital used in the business sector. Including the grants and credit subsidies with investment would thus take account of the federal share in the costs of these investments.

If NIPA principles were extended to government budgets, however, adjustments for investments financed from grants would be included in NIPA data on state and local budgets. This would follow from applying the direct NIPA concepts described in Chapter IV for

federal spending to all government accounts. Thus, in a unified national accounting system, federal budgets would have to reflect both the grant-investment and its immediate transfer to the owning-and-operating state or local government agency so that costs for operating, maintaining, and depreciating the assets could be properly reflected. The data of federal saving and the measure of the federal deficit would remain unchanged. Most credit subsidies for physical investment--largely for housing--are already included in national data. Since information about the quality of investments under grants and subsidized loans is as sparse as that for direct federal investment, measures of investment based on grant outlays or credit subsidies may overstate the value of the investments being undertaken.

Capital Grants to State and Local Governments

Over the last 15 years, federal capital grants to states and local governments have fluctuated around $22 billion a year (in 1982 prices), financing about $11 billion a year in estimated net state and local investment, after deducting straight-line depreciation of assets financed under past grants.2/ Net investment is shown in Table 8, and gross investment from federal grants in Appendix Table B-5.

Compared with overall state and local investment, however, federal grant assistance has been much more stable. The $11 billion a year in net investment from grants (after straight-line depreciation) contrasts with a fall in overall net investment by states and localities from $40 billion in 1970 to about $19 billion of net additions to capital in 1986, with implied negative net investment from sources other than

2. Net investment financed from grants has been estimated using Bureau of Economic Analysis assumptions for service lives of state and local assets, and the depreciation rules for physical assets described in Chapter III. As with federal physical investment, trends for grant-financed capital improvements are similar under both measures of depreciation, and estimates differ only in the levels of net investment accounted. Estimates based on straight-line asset deterioration are used in the main discussion because the assets financed--highways, transit, wastewater, and so on--are subject to wear-and-tear through use.

TABLE 8. NET PHYSICAL INVESTMENT BY STATES AND LOCALITIES FROM GRANTS AND OTHER SOURCES
(NIPA basis, in millions of dollars, at 1982 prices)

	Net Investment from Grants to Cities (Type 1)				
	Urban Development	Transit Systems	Wastewater Treatment	Airports	Subtotal
1949	0	0	3	144	147
1959	316	0	154	189	658
1969	1,857	173	516	184	2,730
1970	3,550	138	661	112	4,461
1971	3,848	255	1,176	124	5,402
1972	4,019	360	1,133	301	5,814
1973	3,835	453	1,347	401	6,036
1974	3,019	660	3,740	409	7,829
1975	3,309	937	3,191	311	7,748
1976	3,917	1,115	5,156	240	9,428
1977	4,331	1,347	4,634	448	10,760
1978	4,056	1,335	4,137	623	10,150
1979	4,468	1,498	4,304	518	10,788
1980	4,848	1,714	4,406	449	11,416
1981	4,324	1,736	3,527	271	9,858
1982	3,495	1,338	2,763	169	7,766
1983	2,939	1,255	1,890	285	6,369
1984	2,909	1,174	1,631	453	6,167
1985	2,788	773	1,796	485	5,842
1986	2,003	515	1,757	525	4,800

SOURCE: Congressional Budget Office, based on data from the Office of Management and Budget and the Bureau of Economic Analysis.

grants between 1981 and 1984.3/ Since the two-year period 1982-1983, however, the trend in overall state and local net investment has been strongly upward, for the first time since the late 1960s. Should

3. This measure uses straight-line depreciation deductions. The Type 2 measure also shows a large decline in state/local net investment, but the surplus over grants, though smaller, remains positive throughout the 1970s and 1980s. See Table 8.

TABLE 8. (Continued)

Net Investment from Other Grants (Type 1)			Net Investment by State and Local Governments			
Highways and Streets	Emergency Public Works	All Other	Federal Grants (Type 1)	Federal Grants (Type 2)	All Sources (Type 1)	All Sources (Type 2)
1,715	-60	20	1,821	2,108	11,116	18,979
9,845	-82	511	10,934	12,051	29,077	41,377
8,146	-123	1,503	12,256	16,099	46,736	64,714
8,519	-125	1,355	14,210	18,353	40,575	60,041
8,440	-125	1,177	14,893	19,408	37,140	57,468
7,122	-125	1,049	13,860	18,735	34,403	55,224
5,319	-124	960	12,190	17,332	30,657	52,586
4,532	-123	1,075	13,313	18,834	31,376	54,159
3,823	-122	798	12,247	18,091	27,038	50,793
5,046	91	764	15,328	21,589	22,071	45,695
4,740	1,620	675	17,795	24,598	15,400	39,728
4,048	3,547	390	18,135	25,395	18,512	42,920
4,002	1,463	320	16,573	24,302	15,499	39,443
4,253	107	181	15,956	24,149	15,146	40,816
3,795	-195	78	13,536	22,198	9,129	33,262
3,141	-242	-102	10,563	19,581	6,239	30,135
4,037	-269	72	10,209	19,517	5,866	30,743
5,352	-267	171	11,423	21,054	9,383	32,596
6,050	-265	216	11,844	21,613	13,831	38,768
6,724	-263	157	11,417	21,514	19,118	43,913

NOTE: Type 1 net investment deducts equal annual amounts for depreciation. Type 2 net investment deducts assets as they are withdrawn from service.

the upward trend continue, any further reduction in grants may simply lower the federal share of public works investment, but not reduce its total.

Significant changes in the composition of federal grant financing are also relevant. Although federal aid for highways has historically been the largest single capital grant program, total federal assistance to cities, through grants for urban development, transit systems, wastewater treatment plants, and airport construction, has histori-

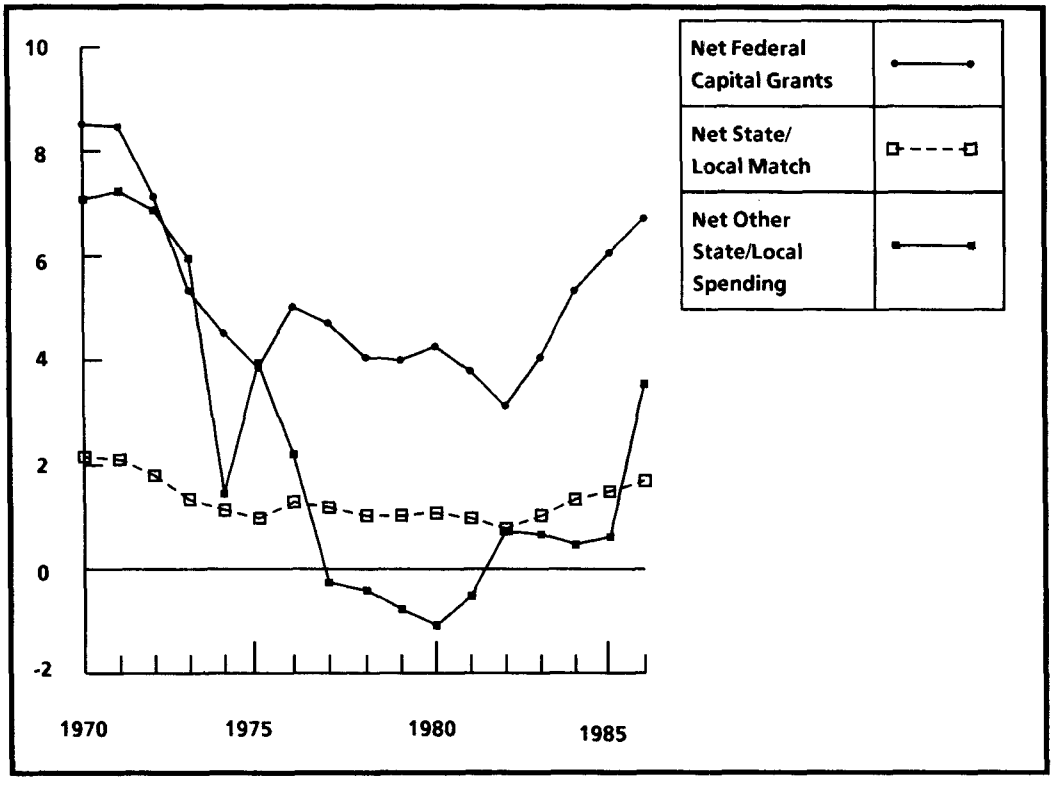
cally been much larger. Throughout much of the 1970s, federal grant aid for highways was $8 billion to $9 billion a year (in 1982 prices) compared with grants for urban areas (except for urban highways) totaling $11 billion to $14 billion annually. These amounts financed net investments of around $4 billion in the highway system, and $7 billion to $10 billion in the cities. Much of the emergency public works assistance of the late 1970s also financed investments in cities. But since the major increase in highway spending authorized by the Surface Transportation Assistance Act of 1982, together with reductions in urban development programs, highway programs have rapidly come to dominate federal capital grant aid to states. By 1985, net highway investment from grants was half of all grant-financed net investment, and in 1986 it was 40 percent more than the level of net additions to cities' assets from grants.

Highways

Until the recent increase in highway grants, the dominant factor affecting state and local highway investment levels was not federal grants but the rapidly declining spending on nonfederal-aid highways--principally on the 500,000 road miles in cities and 2,500,000 road miles in rural areas that are not on the federal-aid system. Between 1969 and 1977, spending on the unaided systems fell from $12 billion to a fairly stable level of $5 billion a year. During the 1970s, investment in local rural roads off the federal-aid system fell by about one-fifth (after accounting for price changes), and that for local urban streets fell by one-eighth, while the states' own investment in state highway networks dropped by over 70 percent. By 1980 the federal grant program (together with state and local matching funds) was contributing half of national highway improvements.

While increases in highway taxes and federal grants for highways have, since 1982, pushed up the national spending total, they have had no apparent effect in improving the condition of the most deteriorated roads, for which spending has risen only marginally. From about 1977 to 1981, spending on unaided highways was barely sufficient to offset estimated depreciation so that net investment in city streets and rural areas was low and may even have been negative (see Figure 7). In 1985, some 36 percent of minor rural roads rated in fed-

FIGURE 7. NET INVESTMENT IN HIGHWAYS BY SOURCE
(In billions of dollars at 1982 prices)



SOURCE: Congressional Budget Office, based on data from the Bureau of Economic Analysis and the Federal Highway Administration.

NOTE: Net investment in this figure is based on deducting equal annual amounts for depreciation. Net other spending includes net state/local investment on nonfederal-aid projects and other major improvements not classed as investment by the Bureau of Economic Analysis.

eral pavement monitoring were unpaved, and the roads as a group were in only fair condition on average. Most city roads are not included in the pavement rating system, but nearly two-thirds of the urban collector system, which includes some 20,000 miles of city-funded roads, was rated at fair or worse condition. By comparison, 60 percent of the interstate system and half of other major highways were reported in very good or excellent shape.4/

Little is known about the national economic benefits of highway investments. According to previous CBO estimates, for about 40 per-

4. Federal Highway Administration, *Highway Statistics 1985*.

cent of the remaining interstate construction program, benefits to highway users would not support investment. In addition, declining pavement conditions on the most heavily trafficked parts of the federal-aid network--the rural and urban interstate segments--coupled with improved conditions on less traveled systems, showed that the broad national benefits from highway spending could be raised by concentrating on improvements for busier roads or for highways in the worst condition.5/

Similar comparisons for overall nonhighway assistance to cities are not possible because grant aid under block grants--including both urban and community development programs as well as the public works assistance of the 1970s--cannot be allocated to specific purposes. (By default, therefore, all such financing is included in these comparisons as spending from nonfederal sources.) Moreover, experience in the three specific grant programs affecting cities differs.

Airports

Only in airports is overall net investment relatively independent of grant financing. Federal grants for airport construction have financed net improvements varying around $400 million a year since 1975, while overall net investment has been increasing (varying with both expansion needs and borrowing cost, since it is largely debt-financed) along an upward trend of around 8 percent annually during the 1980s. In 1985, net airport investment from all sources stood at just over $1 billion. Should the trend in total spending continue, overall net improvements in airports in 1988 would be in the range of $1.2 billion.

Wastewater

A sharp decline in nonfederal sources of net investment in wastewater treatment began in 1979, followed by a resumption of nonfederal funding in 1984 to levels that are now around the same rate as during the 1970s (see Figure 8). Several factors probably contributed to the rapid decline in net investment from 1979 through 1983.

---

5. Congressional Budget Office, *Federal Policies for Infrastructure Management* (June 1986).